Original Research Article

Effect of Vecuronium in different age group

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Abstract

Background: Muscle relaxants are adjuncts to good anesthesia. Neonates and infants are having less developed neuromuscular junction, larger distribution volume and poor hepatic and renal function. The aim of the present study was to define dose of Vecuronium in neonates and infants in comparison of other age groups, to observe cardiovascular effect of Vecuronium, to study adequacy of intubating condition and, Adequacy of intra-operative muscle relaxation, To observe completeness of recovery after reversal.

Materials and methods: 100% patients belonging to physical status of A.S.A Group I and II for operative procedures from both routine and emergency surgeries were selected randomly for study to observe clinical Comparison of Vecuronium bromide in different age groups. Patients were divided into 4 groups each consists of 25 Patients: Group I - Patients of 0-1 year of Age, Group II - Patients of 1-5 year of Age, Group III - Patients of 6-15 year of Age, Group IV - Patients of 16-50 year of Age.

Results: Mean pulse rate before induction in Group I patient was 143.92/min., it increased to 151.92 /min. after intubation and then maintained throughout the course of anesthesia between 143.68 to 146.28 / min. which was not significant. The mean arterial pressure in Group I patient was maintained between 74.32 mm of Hg, 77.24 mm of Hg in Group II from 84.21 of pre-induction value – small changes were there and MAP maintained between 79.9 to 89.3 mm of Hg. Pre-induction MAP in Group III was 87.95 mm of Hg, it maintained between 89.29 to 92.66 mm of Hg throughout and in Group IV pre-induction value of MAP was 94.62, where it was maintained between 91.78 – 98.5 mm of Hg. So, there was no any pulse rate or blood pressure changes reflecting cardiovascular stability of Vecuronium.

Conclusion: Vecuronium is an excellent non-depolarizing muscle relaxant which is an intermediate duration of action in adult but of longer duration in neonates and infants (less than 1 year). It is having advantage of – Cardiostability, Lack of Ganglion blocking action, Lack of histamine release, Non cumulative property, Excellent conditions for intubation, Excellent muscle relaxation, Complete recovery without any complication.

Key words

Vecuronium, Different age group, Cardiovascular effect.

Introduction

Muscle relaxants are adjuncts to good anesthesia. Neonates and infants are having less developed neuromuscular junction, larger distribution volume and poor hepatic and renal function. Vecuronium [1] is not clearly an intermediate duration acting non depolarizing drug in neonates and infants. The aim of the present study was to define dose of Vecuronium in neonates and infants in comparison of other age groups, to observe cardiovascular effect of Vecuronium, to study adequacy of intubating condition and, Adequacy of intraoperative muscle relaxation, to observe completeness of recovery after reversal.

Materials and methods

100% patients belonging to physical status of A.S.A [2] Group I and II for operative procedures from both routine And emergency surgeries were selected randomly for study to observe clinical Comparison of Vecuronium bromide in different age groups. Patients were divided into 4 groups each consists of 25 Patients:

Group I - Patients of 0-1 year of Age.
Group II - Patients of 1-5 year of Age.
Group III - Patients of 6-15 year of Age.
Group IV - Patients of 16-50 year of Age.

Criteria for selection of Patients:

- All Patients were healthy, no other system or metabolic disorder.
- Patients were not having any neuromuscular disease or not receiving any drugs which may alter response to muscle relaxants.
- History of any allergic disease and drug sensitivity was asked for in each patient. Patients with such history were executed from study.
- Patients were selected for abdominal surgery, rental surgery, obstetrical surgery, E.N.T. surgery and others up to 2 Hr. duration

All the patients were subjected to pre- anesthetic assessment in detail.

Pre – medication with an anesthesiologist: Inj. Glycopyrolate - 0.004 to 0.008 mg/kg or Inj. Atropine - 0.01 to 0.2 mg/kg with intraoperative monitoring Vitals. SpO2 monitored before pre-medication, before induction after intubation, 5 min. after intubation and Then 10 minutes till completion of anesthesia. Electro – cardiogram was monitored in adult patient. Neuromuscular block monitored with peripheral nerve Stimulator in all but very small children when response could not be obtained. Neuromuscular block monitored with movement of abdominal muscle, surgical muscle, relax with and movement of respiratory muscle as well. After shifting the patient on operation table, I.V line taken by using appropriate gauge intra catin and 5% dextrose started. After taking vital data, pre- oxygenating was done for 5 minutes.

Induction: Inj. Vecuronium – 0.1 mg /kg slowly and inj. Thiopentone - 5 mg /kg slowly.
Tracheal intubation was done with appropriate size endotracheal tube.
Maintenance: With 33% oxygen + 66% Nitrous Oxide + maintenance doses of Inj. Vecuronium + IPPV + Intravenous inj. Fentangl.

Reversal: At the end of surgery patients were reversed with Inj. Neostigmine - 0.5 mg / Kg + Inj. Atropine - 0.02 mg/ Kg or Inj. Glycopyrrolate - 0.04 mg / kg with 100% oxygen.

Extubation was done after observation of following criteria.

- Regular adequate respiration
- Bucking on endotracheal tube
- Eyelash, Eyelid, conjunctival reflexes present
- Sustained head lift at least for 5 Sec. in adults
- Antigravity moments of limb in adults
- Adults patients following verbal commands on operation table
- Good crying and limb activity in children
- Sustained contractile response of tetanic stimulating on PNS whenever possible.

Extubation was done after through endotracheal and oropharyngeal sanction. Pulse rate, blood pressure, respiration and SpO2 were recorded after extubation.

Results

Changes in pulse rate during various events were as per **Table – 1**. Changes in mean arterial blood pressure during various events were as per **Table – 2**. Changes in Spo2 during various events were as per **Table – 3**. Mean pulse rate before induction in Group I patient was 143.92/min., it increased to 151.92 /min. after intubation and then maintained throughout the course of anesthesia between 143.68 to 146.28 / min. which was not significant. The mean arterial pressure in Group I patient was maintained between 74.32 mm of Hg, 77.24 mm of Hg in Group II from 84.21 of pre-induction value – small changes were there and MAP maintained between 79.9 to 89.3 mm of Hg. Pre-induction MAP in Group III was 87.95 mm of Hg, it maintained between 89.29 to 92.66 mm of Hg throughout and in Group IV pre-induction value of MAP was 94.62, where it was maintained between 91.78 – 98.5 mm of Hg. So, there was no any pulse rate or blood pressure changes reflecting cardiovascular stability of Vecuronium.

Discussion

Infants – because of their poor pulmonary mechanism and increased susceptibility to cardiovascular depressant effects of volatile anesthetic agents, are poor candidate for spontaneous ventilation. In these patients, the combination of tracheal intubation and balanced anesthesia using full doses of muscle relaxants, controlled ventilation, minimum concentration of volatile anesthetic agent or reduced doses of opiods, is recommended [3]. This regimen provides ideal surgical conditions with minimum cardiovascular depression and rapid return of laryngeal reflexes at the conclusion of anesthesia (Wylle and Churchil Davidson – 1995). In pediatric patients, for induction, intubation with inhalational anesthetic agents is preferred but because higher concentration is required which may lead to cardiovascular depression and lower concentration can lead to bronchospasm. So, to avoid circulatory depressant effect of inhalational agents and to avoid repeated doses of suxamethonium, use of non-depolarizing muscle relaxant for intubation is an attractive choice [4]. Among all non-depolarizing muscle relaxants, with reasonable doses, suitable conditions for tracheal intubation cannot be achieved in less than 2-3 minutes. So, short acting muscle relaxants will be required. Neuromuscular junction of an infant is immature, there is only 1/3 store of acetylcholine in cholinergic nerve ending of an infant and in an infant the plasma concentration corresponding to 50V depression of the twitch is only 1/3 of that found in older children and adults so they have threefold more sensitivity at the level of neuromuscular junction (Wylie and Chirchil Davidson – 1995). Because of greater volume of extracellular fluid, there is large volume of distribution for drugs, which leads to longer elimination half life and longer duration of action of various drugs in infants [5]. Again, immature hepatic function and poorly

developed renal functions leads to slow metabolism and excretion. All these factors together leads to longer duration of action of Vecuronium in neonates and infants (Wylie and Churchil Davidson – 1995).

Table – 1: Changes in pulse rate during various events.

TIME		GROUP I (0 to 1 Yr.)	GROUP II (1 to 5 Yr.)	GROUP III (5 to 15 Yr.)	GROUP IV (15 to 50 Yr.)
BEFORE PREMEDICATION	RANGE	112 - 116	100 - 136	80 - 140	72 - 100
	MEAN	139.44	124	107.84	89.12
	S.D	10.25	13.52	14.21	9.83
BEFORE INDUCTION	RANGE	120 - 176	100 - 150	92 - 130	68 - 110
	MEAN	143.92	124.96	109.68	92.16
	S.D	12.64	13.65	12.05	10.5
AFTER INTUBATION	RANGE	130 - 180	120 - 160	100 - 150	72 - 130
	MEAN	145.92	127.52	112.24	95.68
	S.D	12.85	13.64	13.97	14.91
5 MIN. AFTER INTUBATION	RANGE	124 - 170	114 - 150	86 - 140	70 - 120
	MEAN	147.76	130.16	110.16	96.4
	S.D	14.79	13.02	14.6	14.1
15 MIN. AFTER INTUBATION	RANGE	120 - 176	100 - 150	86 - 130	68 - 110
	MEAN	144.84	129.2	110.16	91.12
	S.D	14.24	13.25	14.6	12.42
25 MIN. AFTER INTUBATION	RANGE	120 - 170	100 - 152	86 - 146	68 - 116
	MEAN	145.84	127.2	108.96	89.68
	S.D	14.61	13.09	15.54	11.7
35 MIN. AFTER INTUBATION	RANGE	120 - 180	100 - 146	90 - 136	66 - 110
	MEAN	143.68	126.48	110.52	87.33
	S.D	14.67	14.49	13.26	12.07
45 MIN. AFTER INTUBATION	RANGE	120 - 160	96 - 150	86 - 140	66 - 104
	MEAN	144.91	135.25	111.27	88.11
	S.D	13.45	16.4	14.97	12.05
55 MIN. AFTER INTUBATION	RANGE	110 - 170	100 - 146	90 - 124	68 - 110
	MEAN	146.13	131	109.05	88.22
	S.D	14.83	13.99	12.02	12.5
65 MIN. AFTER INTUBATION	RANGE	116 - 160	100 - 140	86 - 130	66 - 100
	MEAN	143	136.5	107.74	93.8
	S.D	15.08	13.2	12.4	10.97
75 MIN. AFTER INTUBATION	RANGE	130 - 160	104 - 140	86 - 130	68 - 104
	MEAN	146.28	139.6	110.1	89.25
	S.D	11.91	14.6	15.8	13.47
85 MIN. AFTER INTUBATION	RANGE	130 - 160	130 - 156	90 - 130	68 - 100
	MEAN	145.2	139	113.14	86.86
	S.D	13.4	12.27	14.9	10.16
AFTER EXTUBATION	RANGE	130 - 180	120 - 164	100 - 160	76 - 132
	MEAN	152	138	124	106.1
	S.D	12.9	13.65	14.06	15

Table – 2: Changes in mean arterial blood pressure during various events.

TIME		GROUP I (0 to 1 Yr.)	GROUP II (1 to 5 Yr.)	GROUP III (5 to 15 Yr.)	GROUP IV (15 to 50 Yr.)
BEFORE PREMEDICATION	RANGE	67.33-83.33	72.00-93.33	80.00-96.60	80-110
	MEAN	73.29	81.76	88.17	94.4
	S.D	5.27	5.97	6.23	6.59
BEFORE INDUCTION	RANGE	66.00-83.33	73.33-93.33	73.33-104	83.3-110
	MEAN	74.32	84.21	87.75	94.62
	S.D	5.54	5.9	7.15	6.33
AFTER INTUBATION	RANGE	66.60-83.33	73.33-93.33	80-104	86.6-117.3
	MEAN	76.24	82.82	92.04	99.56
	S.D	5.81	6.76	6.13	7.5
5 MIN. AFTER INTUBATION	RANGE	70.00-83.33	73.33-93.33	80-104	83-120
	MEAN	76.87	81.14	91.22	91.78
	S.D	5.43	6.38	6.46	16
15 MIN. AFTER INTUBATION	RANGE	66.00-85.33	72.00-93.33	80-104	80-116.6
	MEAN	74.25	81.83	89.91	94.04
	S.D	5.13	6.07	6.66	9.43
25 MIN. AFTER INTUBATION	RANGE	63.33-83.33	70.00-93.33	80-100.66	80-116.6
	MEAN	72.98	82.83	90.26	94.09
	S.D	5.25	6.6	7.2	9.55
35 MIN. AFTER INTUBATION	RANGE	63.33-80.00	70.00-93.33	78.66-100	80-116
	MEAN	73.65	79.95	90.32	91.45
	S.D	5.1	6.62	6.61	9.3
45 MIN. AFTER INTUBATION	RANGE	63.33-80.00	72.00-93.33	77.33-104	83.3-116.6
	MEAN	73.62	80.33	89.29	96.23
	S.D	5.39	6	7.85	8.2
55 MIN. AFTER INTUBATION	RANGE	63.33-81.33	72.00-93.33	82-107.33	83.3-116.6
	MEAN	74.33	81.06	92.26	96.12
	S.D	5.45	7.66	7.05	9.24
65 MIN. AFTER INTUBATION	RANGE	63.33-83.33	73.33-93.33	83.33-104	83.3-116.6
	MEAN	72.06	79.41	92.37	98.83
	S.D	6	7.43	6.12	9.96
75 MIN. AFTER INTUBATION	RANGE	63.33-83.33	73.33-93.33	83.33-104	83.3-110
	MEAN	72.47	77.6	92.66	96.5
	S.D	7.5	5.11	6.04	9.03
85 MIN. AFTER INTUBATION	RANGE	63.33-82.00	73.33-83.33	83.33-96.66	83.3-110
	MEAN	72.57	77.99	90.75	98.5
	S.D	6.9	5.81	5.27	11.3
AFTER EXTUBATION	RANGE	66.66-83.33	73.33-93.33	83.33-104	86.60-120
	MEAN	77.24	84.21	90.04	97.6
	S.D	5.9	5.9	6.14	7.26

Table – 3: Changes in Spo2 during various events.

TIME		GROUP I (0 to 1 Yr.)	GROUP II (1 to 5 Yr.)	GROUP III (5 to 15 Yr.)	GROUP IV (15 to 50 Yr.)
BEFORE PREMEDICATION	RANGE	96 - 99	97 - 100	97 - 100	97 - 100
	MEAN	97.92	97.88	98.2	98.04
	S.D	0.9	0.67	0.65	0.35
BEFORE INDUCTION	RANGE	98 - 100	96 - 100	97 - 100	97 - 100
	MEAN	98.88	98.28	98.6	98.32
	S.D	0.97	1.13	0.76	0.74
AFTER INTUBATION	RANGE	100	99 - 100	100	98 - 100
	MEAN	100	99.88	100	99.12
	S.D	0	0.33	0	1
5 MIN. AFTER INTUBATION	RANGE	100	99 - 100	100	99 - 100
	MEAN	100	99.96	100	99.12
	S.D	0	0.2	0	0.33
15 MIN. AFTER INTUBATION	RANGE	99 - 100	98 - 100	100	99 - 100
	MEAN	99.84	99.98	100	99.98
	S.D	0.55	0.43	0	0.33
25 MIN. AFTER INTUBATION	RANGE	98 - 100	98 - 100	99 - 100	99 - 100
	MEAN	99.88	99.84	99.92	99.96
	S.D	0.47	0.47	0.2	0.2
35 MIN. AFTER INTUBATION	RANGE	100	98 - 100	100	98 - 100
	MEAN	100	99.8	100	99.7
	S.D	0	0.5	0	0.55
45 MIN. AFTER INTUBATION	RANGE	98 - 100	98 - 100	100	98 - 100
	MEAN	99.88	99.81	100	98.33
	S.D	0.48	0.54	0	0.57
55 MIN. AFTER INTUBATION	RANGE	97 - 100	100	100	98 - 100
	MEAN	99.78	100	100	99.84
	S.D	0.8	0	0	0.5
65 MIN. AFTER INTUBATION	RANGE	100	100	99 - 100	99 - 100
	MEAN	100	100	99.88	99.9
	S.D	0	0	0.34	0.3
75 MIN. AFTER INTUBATION	RANGE	99 - 100	100	100	99 - 100
	MEAN	99.83	100	100	99.87
	S.D	0.4	0	0	0.35
85 MIN. AFTER INTUBATION	RANGE	100	99 - 100	100	100
	MEAN	100	99.75	100	100
	S.D	0	0.5	0	0
AFTER EXTUBATION	RANGE	97 - 100	98 - 100	98 - 100	98 - 100
	MEAN	99.8	99.36	99.46	98.8
	S.D	1.19	0.76	0.82	0.76

The present study was carried out in 100 patients of ASA Group I and Group II ranging from neonates of 15 days to 50 years adults. Patients were divided in 4 groups. Study was carried out to compare maintenance requirement of Vecuronium in infants with other age groups and to see quality of surgical muscle relaxation, cardiovascular stability and adequacy of recovery after reversal.

Mean pulse rate before induction in Group I patient was 143.92/min., it increased to 151.92/ min. after intubation and then maintained throughout the course of anesthesia between 143.68 to 146.28/ min. which was not significant. Mean pulse rate in Group II patients before induction was 124.96/min. which increased to 121.52/min., then it was maintained between 126.48 to 137.6 which was not significant. In Group III patients mean pulse rate was 109.68 / min. at pre-induction time, which increased to 112.24 /min. after intubation and then maintained between 107.74 to 124.0/min. which is insignificant an in Group IV from pre-induction value of 92.16 / min. changes were up to 106/ min., which also are not significant.

The mean arterial pressure in Group I patient was maintained between 74.32 mm of Hg, 77.24 mm of Hg in Group II from 84.21 of pre-induction value – small changes were there and MAP maintained between 79.9 to 89.3 mm of Hg. Pre-induction MAP in Group III was 87.95 mm of Hg, it maintained between 89.29 to 92.66 mm of Hg throughout and in Group IV pre-induction value of MAP was 94.62, where it was maintained between 91.78 – 98.5 mm of Hg. So, there was no any pulse rate or blood pressure changes reflecting cardiovascular stability of Vecuronlum.

These findings are comparable with findings in study of Baraka, et al. (1983). Vecuronium is a cardiostable drug due to absence of effect on ganglion and absence of vagolytic effect [6]. There is absence of histamine release and sympathetic stimulation as studied by Morries, et al. (1983) who in his study found stability in systolic, diastolic and mean arterial pressure, heart rate, rate pressure product, systemic vascular resistance and cardiac output [7].

In Group I from mean 98.88% at pre-induction value, it was maintained between 98.8 – 100%. In Group III also it was maintained between 98.8 – 100%. In Group III and Group IV pre-induction value was 98.6% and 98.32% respectively. In both this group it was maintained between 98-100% throughout anesthesia and after extubation due to use of controlled venticulation and high inspired concentration of oxygen.

Requirement of Vecuronium in Group I (infants less than 1 year) was considerably lower than that of in other groups. Because of immaturity of neuromuscular junction Vecuronium is having lesser EDg5 in infants. Because of immature hepatic and renal junction, duration is longer and as volume of distribution is greater in infants there is slow release from body compartment [8]. Due to higher cardiac output in infants, onset of action is fast in comparison of other age groups. Vecuronium is predominantly eliminated by liver, as esterase activity hydroxylation and phase I biotransformation reactions are not well developed in new-born, prolongation of duration due to slower metabolism occurs [9].

Muscle relaxation was excellent using Vecuronium. It was monitored by movement of abdominal and respiratory muscle movement and with peripheral nerve stimulator whenever response was obtained.

Recovery was complete after reversal of block with inj. Neostigmine 0.05 mg/kg and an anticholnergic. There were no respiratory insufficiency due to residual neuromuscular block in any patient and in no case prolongation of apnea or difficulty in reversal was found. This finding is consistent with that of Ballantan and Chang V, who in 1997 studied 270 patients for residual neuromuscular block who were given either of three non – depolarizing muscle relaxant – Pancuronium, Atracurium or

Vecuronium and concluded that there were minimum cases of post operative residual neuromuscular block with Vecuronium.

There was no any complication like nausea, vomiting, bradycardia, hypotension, prolonged apnea or respiratory insufficiency in any patient.

So, the present study concluded that – by use of balanced anesthesia with muscle relaxant in pediatric patients, cardiac and respiratory depressant effect of inhalational anesthetic agent alone can be avoided. Vecuronium is a cardlostable drug and cardiostability in terms of stable pulse rate and stable mean arterial pressure was maintained in all groups of age from 15 days to 50 years patients. Intubating conditions were excellent with 100 u gm/Kg dose.

Conclusion

Vecuronium is an excellent non-depolarizing muscle relaxant which is an intermediate duration of action in adult but of longer duration in neonates and infants (less than 1 year). It is having advantage [10] of – Cardiostability, Lack of Ganglion blocking action, Lack of histamine release, Non cumulative property, Excellent conditions for intubation, Excellent muscle relaxation, Complete recovery without any complication.

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